



Development of Science Learning Tools using the STEM Approach to Train Problem Solving Ability and Students Activeness in Global Warming Material

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Abstract. The success of learning in schools cannot be separated from planning appropriate learning strategies and learning tools used by teachers in the classroom. The learning device is used by the teacher as a benchmark to see how far the teacher has succeeded in teaching which can be seen when a method in the learning tool is applied. This research aims to produce science learning tools using the STEM approach to train problem solving ability and students activeness on global warming material that is suitable for use to support the learning process. The development procedure in this research refers to the ADDIE development model. Data collection techniques obtained by the method of observation, questionnaires, and documentation. Based on the results of the research, it shows that the learning tools developed have characteristics, including: learning tools with a STEM approach so that they refer to the disciplines of science, technology, engineering, and mathematics; using leaflet media as a learning medium that is used to convey information; taking the theme of global warming as the main subject; there are indicators of problem solving abilities in the learning tools developed; and there are indicators of activity in the learning tools developed. The results of the feasibility test analysis based on the percentage of validation on the presentation and material aspects, namely the syllabus obtained a percentage of 94.60%, lesson plans obtained a percentage of 94.46%, student discussion sheet obtained a percentage of 93.50%, test questions obtained a percentage of 93.34%, the observation sheet obtained a percentage of 95.42%, and the leaflet media obtained a percentage of 97.50%. Meanwhile, the leaflet media also obtained a percentage based on the results of the student response questionnaire on the validity, practicality, and effectiveness aspects of 89.56% which means that the leaflet media is very good to be used to assist the delivery of material in the learning process. Based on this, it can be concluded that science learning tools using the STEM approach to train problem solving ability and students activeness on global warming material are very suitable for support the learning process.

Keywords: Learning tool, STEM approach, global warming.

Introduction

The development of the era that has entered the era of the industrial revolution 4.0 requires a country to be able to compete in a modern way. Teacher 4.0 has a greater responsibility in educating students to face the Industrial Revolution 4.0 (Rachmadtullah, et al., 2020). Likewise, science and technology are developing rapidly in the 21st century. The world of education is required to make a more real contribution in the effort to improve the progress of the nation (Rosdiana, et al., 2017). Science education is one aspect of

education to achieve national education goals. Based on Regulation of the Minister of Education and Culture of the Republic of Indonesia Number 21 of 2016 concerning Basic and Secondary Education Content Standards, it is explained that the competencies that students must achieve in science subjects for Junior High School are one of which is understanding the concepts and principles of Science and their interrelation and applied in solving problems. One of the important components of 21st century education is problem solving ability (Wismath, et al., 2014). Problem solving in the context of learning can help students construct new knowledge, carry out investigations, facilitate learning, and even more so in solving questions in the form of essay tests or essays (Sugiarto, et al., 2016).

Solving problems can be defined as an action in solving everyday and other problems and making decisions carefully, precisely, in harmony, rationally and considering from various points of view (Pistany, et al., 2015). This was also stated by Hidayat, et al. (2017) where one of the 21st century education skills is problem solving ability. However, the facts in the field the problem solving abilities of Indonesian students are not as expected because they are still in the low category. This can be seen from the results of the PISA (Program for International Student Assessment) in 2018 which shows that Indonesia is ranked 74 out of 79 participating countries (OECD, 2019). In this regard, the results of research conducted by Mita, et al. (2019) explained that a collection of PISA questions is a collection of questions that require problem solving.

The results of observations made by researchers during Field Experience Practices at 27 State Junior High School of Semarang showed that learning activities did not provide opportunities for students to explore thinking skills and students' curiosity about problems or phenomena that occurred in the surrounding environment. With such a learning process, students' ability to analyze a problem and conclude the problem can be said to be low. Meanwhile, in the implementation of the learning process in schools, only textbooks are used as a learning resource and are carried out by the teacher by explaining in front of the class, but only some students pay attention. Prastiwi (2018) also show that problem solving skills in class VII Junior High School students are only 41.94%. Rostika & Junita (2017) states that the factor of the low ability of student problem solving is that they do not get students used to solving problems related to everyday problems. In addition, students who asked questions to the teacher were only 38.7% of the 31 students, most students felt afraid and lacked confidence in expressing opinions and answering questions from the teacher. This shows that students have not been actively involved during the learning process, one of which is seen when students do not dare to ask other students or teachers. Most students feel afraid and lack confidence in expressing opinions and answering questions from the teacher.

The way of packaging learning experiences designed by the teacher is very influential on the student learning process. Science learning in the 2013 curriculum has a reference in choosing a learning model by considering the characteristics of the learning material. This learning model involves project based learning (PjBL), problem based learning (PBL), or discovery learning (Afriana, et al., 2016). Science learning can also be done by linking knowledge and real life, using an integrative approach. Sukmana (2017) explains that STEM is an integrative learning approach because it combines four main areas in education. According to Parno, et al. (2020), the basic concepts of science and problem-solving processes in PBL can be related to STEM. PBL is a learning model that train learners to think actively to solve daily contextual problems (Potturi et al., 2016). Utami, et al. (2017) also stated that one of the lessons that can integrate 21st Century Skills is STEM (science, technology, engineering, and mathematics).

STEM learning is closely related to the 2013 curriculum, which integrates science, engineering, technology, and mathematics which then can consistently improve 21st century skills (Oktapiani & Hamdu, 2020). According to Khoiriyah, et al. (2018), a learning approach using STEM can seek to bring up skills in students, for example the ability to

solve problems and the ability to carry out investigations. The STEM approach with a discussion learning pattern is able to maximize students' ability to be more active in thinking, be directly involved in learning, and explore their knowledge (Ariani, et al., 2019). According to Ismail, et al. (2016), the integration of the STEM approach with analytical and problem-solving skills will help students to prepare them for a real-life work environment. Cahyaningtyas & Roektingroem (2018) explains that learning with an integrated pattern between STEM can train students to hone cognitive, explore creativity, innovation, manipulative and affective and apply knowledge as a form of problem solving related to the environment by utilizing technology. Meanwhile, there is evidence that the STEM approach can improve the quality of the learning process (Guzey, et al., 2017).

Global warming is one of the science materials studied at the seventh grade Junior High School level. Delivering global warming material certainly requires a medium capable of integrating the concept of material appropriately. Sumarauw, et al. (2017) explain that a learning media that is able to increase the desire and curiosity of students is also needed for the achievement of learning completeness. The use of instructional media can foster students' interest in learning new things in learning materials delivered by teachers and interesting learning media can stimulate students in the learning process (Nurrita, 2018). One of the learning media that can be used as an alternative to student learning is printed media in the form of leaflets. Leaflets are written printed materials in the form of sheets that are folded but not turned off or sewn (Depdiknas, 2008). The results of research by Farida, et al. (2020) stated that leaflet media can increase students reading interest so that student learning activities in the learning process continue to increase.

Good learning implementation can be realized when all the elements in learning are available. Learning with leaflet media also requires a learning device. Learning tools are an important component in determining student success in learning a material (Akhlis & Dewi, 2016). Based on this background, it is necessary to develop learning tools. The STEM approach was chosen as an attempt to bring out skills in students in the 21st century. According to Agustina, et al. (2020), the purpose of learning with the STEM approach is suitable for application in secondary school learning where the subject in learning requires complex knowledge. In line with previous research by Mu'minah & Aripin (2019) which states that STEM is able to combine mastery of academic concepts with real-world learning that can be applied in everyday life, where students who are educated with STEM are expected to be able to solve problems, become logical thinkers, mastering technology and can link culture with learning. Fathoni, et al. (2020) also revealed that STEM learning is successfully applied to science and makes students better understand what they are learning. These learning tools are expected to help make it easier for teachers to deliver learning materials and increase teacher knowledge in using various learning methods.

Method

The research location for the development of learning tools was carried out at the Faculty of Mathematics and Natural Sciences, Universitas Negeri Semarang and 27 State Junior High School of Semarang. The research time to develop science learning tools was carried out in December 2019 - October 2020. The subjects in this study involved experts (lecturers and teachers) who would become validators related to the content of the product to be developed and students in the media readability test in the learning tools developed. In this study, the readability test was carried out by involving 15 students of class VII A.

The research method used is the research and development (R & D) method with the ADDIE model. The ADDIE development model consists of five stages which can be seen in Figure 1. The development procedure in this research is through the following steps:

- a. The analysis phase includes defining the problem and identifying the learning environment, characteristics and knowledge that students have.

- b. The design stage is carried out by designing the learning device along with the collection of materials or learning device materials.
- c. The development stage is the process of making learning devices that have been designed in the design stage.
- d. The implementation stage includes product testing activities for students. However in this study the implementation stage was not carried out due to the COVID-19 pandemic so it was not possible to carry out learning activities in schools that triggered crowds.
- e. The evaluation stage of the results of the feasibility assessment of learning tools developed based on the results of expert assessments (lecturers and teachers) and student responses. However, it is possible that the evaluation stage is carried out at each stage of development which is used to improve the product.

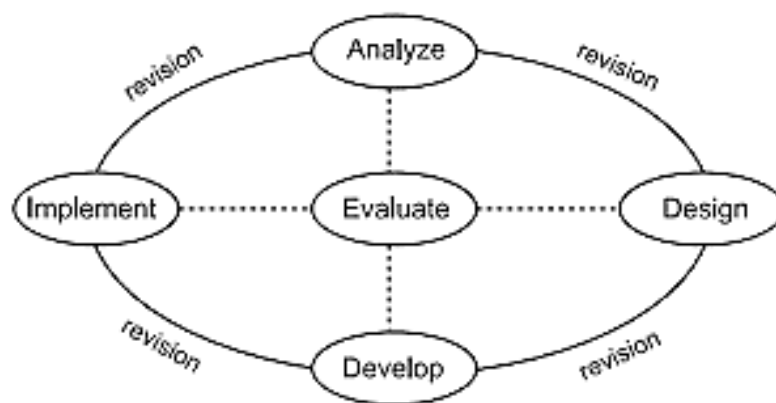


Figure 1. ADDIE stages according to Branch (2009)

Data collection techniques in this research are the method of observation, questionnaires, and documentation. The instruments used in this study were test and non-test questions consisting of expert validation questionnaires to evaluate learning devices and a readability questionnaire sheet students regarding the use of leaflet learning media. The test instrument analysis was carried out using the Aiken V formula with an assessment of 5 experts. The question is said to be valid if $V \text{ count} \geq V \text{ Table}$. Meanwhile, the non-test instrument was carried out with construct validation using expert opinion.

Data analysis was carried out descriptively and quantitatively based on expert judgment and student responses. The experts is a lecturer in the Integrated Science department and a science subject teacher. Experts and students fill out the assessment sheet by giving a score according to the rubric listed. The expert assessment sheet instrument and student responses were analyzed by calculating the number of scores obtained, divided by the total score, multiplied by 100% (Sudijono, 2010). The results of the percentage of feasibility test data and responses are then converted into the assessment criteria based on Table 1.

Table 1. Assessment criteria

Interval (%)	Criteria
$81.25 < \text{score} \leq 100$	Very worth it
$62.50 < \text{score} \leq 81.25$	Well worth it
$43.75 < \text{score} \leq 62.50$	Decent enough
$25.00 < \text{score} \leq 43.75$	Not worth it

Based on the assessment criteria, the learning device can be said to meet the eligibility if the percentage of the assessment score is $> 62.50\%$. If the percentage of the assessment results is $\leq 62.50\%$, it needs to be revised again.

Results and Discussion

This research is a research and development study. The results of this research on the development of learning tools will be presented in two parts, including: (1) the characteristics of science learning tools using the STEM approach to train students problem solving ability and activeness in global warming material; and (2) the feasibility of science learning tools using the STEM approach to train students problem solving ability and activeness in global warming material. The development of science learning tools uses the ADDIE development research model according to Branch (2009). The learning tools developed in detail are described as follows.

The Characteristics of Science Learning Tools

1. Syllabus

The syllabus was made with due observance to the regulations of the Minister of Education and Culture of the Republic of Indonesia Number 22 of 2016 concerning the standard of primary and secondary education processes. Core Competencies and Basic Competencies in the syllabus are made based on the Regulation of the Minister of Education and Culture of the Republic of Indonesia Number 37 of 2018. The syllabus prepared is used to train problem-solving skills and student activeness. This can be seen in the learning and assessment activities given. In addition, the learning activities in the syllabus also contain STEM disciplines and 5M steps (observing, asking, trying, analyzing, and communicating). The characteristics of the syllabus in this study are described in detail as follows:

- a. Syllabus contains: a section title; subject identity; school identity; class or semester; core competence; basic competence; indicators; main material; learning activities; assessment; time allocation; learning resources.
- b. Core competencies consist of: spiritual attitudes; social attitudes; knowledge; skills.
- c. Basic competence in this research is Basic Competence 3.9 analyzing climate change and its impact on ecosystems and Basic Competence 4.9 writing about the idea of adaptation or coping with climate change problems.
- d. Indicators that refer to Basic Competence and aspects of the STEM approach so that they contain the disciplines of science, technology, engineering, and mathematics.
- e. The main subject of this research is class VII global warming.
- f. Learning activities include aspects of the STEM approach and 5M activities, namely observing, asking, trying, analyzing, and communicating.
- g. Learning assessment techniques consisting of test questions and observation sheets to assess problem solving abilities and student activity.
- h. The time allocation is written in each learning meeting.
- i. Learning resources include: media leaflets, teacher books, student books, other relevant science books, journal articles, and the environment.

The characteristics of the syllabus were specifically developed using the STEM approach and also using the Problem Based Learning model. The components of the STEM approach can be seen from the steps of learning activities. STEM learning is designed as an alternative innovation based on a thematic curriculum (Oktapiani & Hamdu, 2020). The development of a STEM-based PBL model by Sarnita, et al. (2019) stated that learning devices are said to be effective in use, able to actively involve students in learning, and these students can also solve problems in their daily life.

2. Lesson Plan

The lesson plan was made with due observance of the regulations of the Minister of Education and Culture of the Republic of Indonesia Number 22 of 2016 concerning the

standard of the primary and secondary education process. Core competencies and basic competencies in the lesson plan are made based on the Regulation of the Minister of Education and Culture of the Republic of Indonesia Number 37 of 2018. The characteristics of the lesson plan in this study are described in detail as follows:

- a. Lesson plan contains: part of the title; subject identity; school identity includes the name of the educational unit; class or semester; core competence; basic competence; indicators; learning objectives; learning materials; learning methods; learning steps; time allocation; assessment; learning resources.
- b. The core competencies consist of: spiritual attitudes; social attitudes;; and skills.
- c. Basic Competence in this research is basic competence 3.9 analyzing climate change and its impact on ecosystems and basic competence 4.9 writing about the idea of adaptation or coping with climate change problems.
- d. Indicators that refer to basic competence and aspects of the STEM approach so that they contain the disciplines of science, technology, engineering, and mathematics.
- e. The material in this research is global warming material for grade VII even semester.
- f. Leaflet media of global warming are used as a learning resource.
- g. Learning activities use the STEM approach and uses the PBL model syntax.
- h. The learning activity includes 5M steps.
- i. The assessment consists of a cognitive assessment to assess students problem solving abilities and affective assessments to assess student activeness.

The characteristics of the lesson plan were specifically developed using the STEM approach. Kelley & Knowles (2016) explained that the process of integrating science, technology, engineering, and mathematics in authentic contexts can be as complex as the global challenges that demand a new generation of STEM experts. Lesson plan with the STEM approach has advantages, namely the existence of an engineering process, so that students can design products as the application of knowledge during the learning process. The National Research Council (2014) has defined engineering as a body of knowledge about the design and creation of man-made objects and a process for solving problems.

3. Student Discussion Sheet

Student discussion sheet developed on global warming material. Student discussion sheets are made by paying attention to the rules of the Regulation of the Minister of Education and Culture of the Republic of Indonesia Number 23 of 2016 concerning assessment standards. The questions that must be done by students in each part of the student discussion sheet are adjusted to the indicators. The activity of answering questions aims to practice problem solving skills and student activeness. The characteristics of the student discussion sheet on the development of learning tools in this study are described in detail as follows:

- a. Student Discussion Sheet is divided into three sub-materials: sub-material on the greenhouse effect and causes of global warming at the first meeting, sub-material on the concepts and causes of global warming at the second meeting, and sub-material on the impact and efforts to tackle global warming at the third meeting.
- b. The material is in accordance with the indicators in basic competence.
- c. Discussion activities at student discussion sheet consist of presenting problems adapted to global warming sub-material, investigations, and problem solving.
- d. The student discussion sheet developed contains aspects of the STEM approach.
- e. The language used is simple, communicative, and clear Indonesian, making it easier for students to understand how to solve problems.

Student discussion sheet developed contains components of the STEM approach. According to Hasanah, et al. (2021), learning with STEM makes students discuss with each other expressing their ideas and thoughts to answer the questions on the discussion sheet according to the steps in the lesson. Integration of STEM in problem-based learning was able to guide students in solving problems. Student discussion sheet development was

intended to measure how far students had understood global warming material before working on test questions for assessment that refer to problem solving ability.

4. Cognitive Assessment Instruments (Test Questions)

The test questions are made by paying attention to the rules of the Regulation of the Minister of Education and Culture of the Republic of Indonesia Number 23 of 2016 concerning assessment standards. The assessment of knowledge uses a written test with questions in the form of descriptions. The test questions contained four stages of problem solving according to Polya (1973). The stages of problem solving according to Polya (1973) are: (1) understand the problem; (2) foreign exchange plan; (3) carry out the plan; and (4) looking back. Then the questions are made based on indicators of problem solving abilities which are then developed into questions used to measure students' problem solving abilities. According to Purwaningsih, et al. (2020), the use of specific domain problem solving instruments can provide an overview of student problem solving.

The characteristics of the problem solving ability test questions in this study are described in detail as follows:

- a. The instrument for the test consisted of question identities, question lattices, and text questions in the form of descriptions with a total of 10 items.
- b. Assessment of cognitive aspects in the form of description questions that refer to indicators of problem-solving abilities with cognitive aspects and answer keys.
- c. The questions are adjusted to the core competencies, basic competence 3.9 analyzing climate change and its impact on ecosystems, and indicators of achievement of global warming material competency for grade VII even semester.
- d. The language used in the test question instrument is Indonesian which is simple, communicative, and clear so that it makes it easier for students to understand the questions but does not reduce the difficulty level of the questions.

Question development is used for the pretest and posttest as a learning evaluation tool. In this study the test questions were developed only up to the validation stage and the analysis of the results of the assessment of the items using the Aiken's V formula which was carried out by five validators in accordance with the construct assessed from (1) the relevance of competencies, indicators of competency achievement, indicators of questions, questions, and level. bloom taxonomy; (2) easy to understand; and (3) systematic. In general, the validation results show that the test items are very suitable to be used to support learning activities and based on the validity of the items carried out using the Aiken's V formula, all questions are declared valid at the 5% difficulty level.

5. Affective Judgment Instrument (Observation Sheet)

The observation sheet is made with due observance to the rules of the Regulation of the Minister of Education and Culture of the Republic of Indonesia Number 23 of 2016 concerning assessment standards. Attitude assessment is carried out by observing or observing student behavior. The observation sheet is made based on the activeness indicator which is then developed to measure the activeness of students at each meeting. The observation sheet contains six indicators of activity according to Sudjana (2010). The indicators of activeness used for attitude assessment are (1) participating in carrying out their learning assignments; (2) involved in problem solving; (3) ask other students or teachers if they do not understand the problem at hand; (4) trying to find various information needed to solve the problem; (5) train themselves in solving problems given by the teacher; and (6) assessing his own abilities and the results obtained.

The characteristics of the activeness observation sheet in the development of learning tools in this study are described in detail as follows:

- a. The observation sheet instrument consists of an identity sheet, work instructions, a student identity column, an assessment score column along with an assessment rubric.

- b. Assessment of the affective aspect in the form of observation refers to the activeness indicator.
- c. The language used is Indonesian which is simple, communicative, and clear, making it easier for the observer to assess the activeness of students.

6. Leaflet Media

Leaflet media in learning tools are intended to help make it easier for teachers to convey information about the material that must be studied by students. Media leaflets that are made are adjusted to basic competencies, indicators, and learning objectives in the 2013 curriculum for Junior High Schools. Leaflet media is made in A4 size (21 cm x 29.7 cm), folded in thirds. Display designed in full color; use language that is simple, concise, and easy to understand; and equipped with illustrations. The purpose of learning media in the form of leaflets that was created and developed was to minimize the various learning problems that exist in 27 State Junior High School of Semarang in particular and other Junior High Schools in general. In addition, it is also hoped that it can be used to foster students' interest in learning new things in learning materials.

- a. Leaflet media consists of three sub materials.
- b. The leaflet media cover contains: a section title; agency logos; the title of the material; class and semester identity; images that refer to the material; basic competence; indicators; and the identity of the author.
- c. Leaflet media refers to aspects of the STEM approach.
- d. The color selection design for leaflet media was developed with a different color composition for each sub-material.
- e. Media leaflets contain material on global warming accompanied by pictures and illustrations to motivate students to learn.
- f. The material on the leaflet media was adjusted to basic competence 3.9 and the indicators of competency achievement in global warming material for grade VII.
- g. The language used is simple, concise, communicative, and clear Indonesian, making it easier for students to understand the material.

The Feasibility of Science Learning Tools

The feasibility of science learning tools with the STEM approach to train students problem solving ability and activeness in the developed global warming material can be seen based on the validation results. The validation of learning tools was carried out by lecturers from the Department of Integrated Science, Universitas Negeri Semarang and science teachers at 27 State Junior High School of Semarang. Each consists of five validators. The results of the due diligence can be seen in the Figure 2 below.

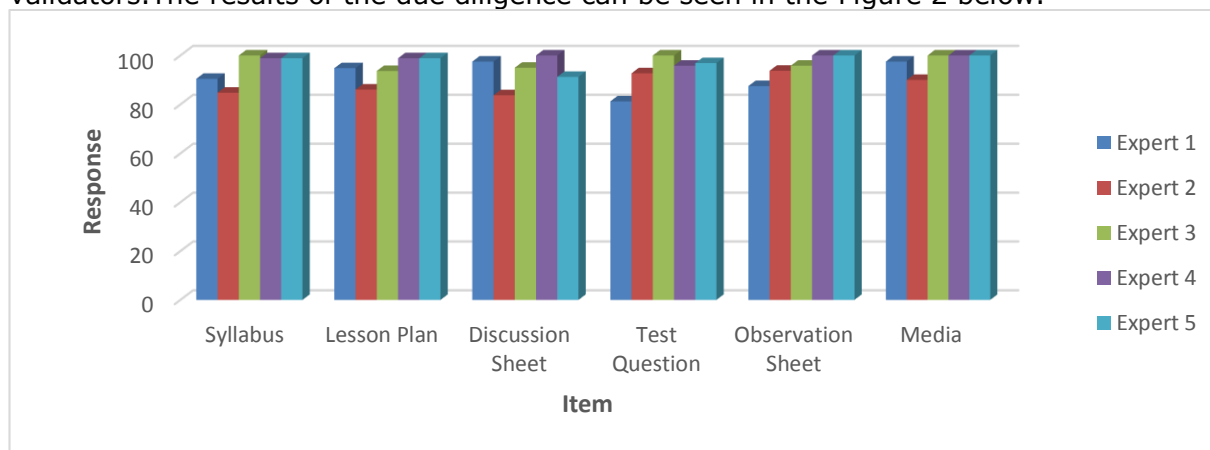


Figure 2. The results of the feasibility test of learning tools

Determination of the assessment criteria on the instrument using a Likert scale. Based on the graph above, it is found that all the experts stated that the learning tools developed obtained criteria were very suitable for use. The assessment of the learning tools developed cannot be separated from some input by experts. Input from experts is used as a consideration for making revisions. Input by experts can be seen in Table 2 below.

Table 2. Expert Input and Revision Results

Product	Suggestion	Repair
Syllabus	<ul style="list-style-type: none"> - Indicators, assessment techniques, and time allocation are written down at each meeting - Learning objectives and indicators are adjusted to STEM 	<ul style="list-style-type: none"> - Write down indicators, assessment techniques, and time allocation for each meeting - Matching learning objectives and indicators with STEM
Lesson Plan	<ul style="list-style-type: none"> - Learning objectives are defined accordingly Audience, Behavior, Condition, Degree elements - Group formation ≤ 5 students 	<ul style="list-style-type: none"> - Describe the learning objectives according to Audience, Behavior, Condition, Degree - Form groups of 4-5 students
Discussion Sheet	<ul style="list-style-type: none"> - Includes news sources - Greenhouse effect modeling activity accompanied by illustrations 	<ul style="list-style-type: none"> - Include news sources - Add an illustrative image to the modeling of the greenhouse effect
Test Question	One of the questions changed about the relationship between livestock and global warming	Revise one of the questions about the linkage of livestock to global warming
Observation Sheet	The observed aspects/ activity observation indicators are shortened	Shorten the observed aspects/ activity observation indicators
Media	<ul style="list-style-type: none"> - The color selection on the leaflet uses a 3-4 color composition - Contrasted the word STEM on the cover of the leaflet title 	<ul style="list-style-type: none"> - Use a 3-4 color composition in the leaflet color selection - Contrast the word STEM on the cover of the leaflet title

Media leaflet that have been revised based on input and suggestions from experts are then made videos that are uploaded to YouTube. The video was made to make it easier for students to assess according to the questionnaire that had been distributed. Filling in this questionnaire is done online using the google form so that after seeing the video related to the leaflet, students can fill out the questionnaire via the link provided. The distribution of questionnaires was carried out on a media readability test involving 15 students. Respondents gave responses in the form of Strongly Agree, Agree, Disagree, and Strongly Disagree. Based on the data analysis, it was obtained that the average student response questionnaire results were 89.56%, which means that the leaflet media was very well used as a medium to assist the delivery of material.learning. The results of the questionnaire responses regarding the use of leaflet media can be seen in Figure 3 below.

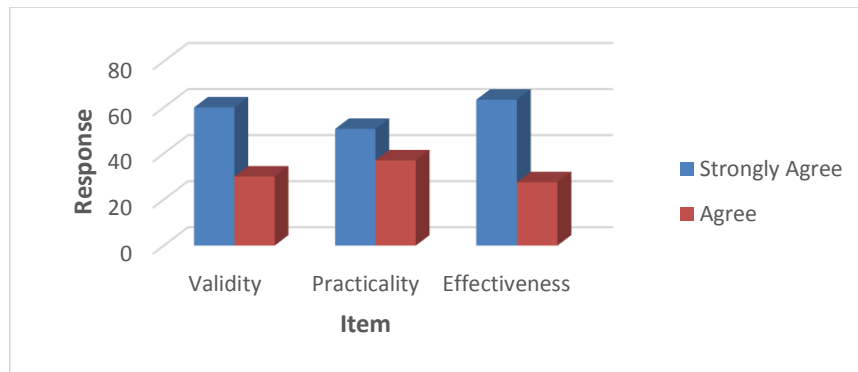


Figure 3. Student Readability Questionnaire Results

Based on the results of the student response questionnaire analysis related to leaflet, students stated that the pictures on the leaflet media were according to the theme and presented to support the clarity of the material concept, the language used in the leaflet media was easy to understand, and the type and size of the letters used were simple and easy to read. Leaflet media has the ideal size to use. According to them, the leaflet media design is attractive, the leaflet media cover design has appeal and describes the content of the material presented, the color combination of the leaflet media is compatible, the use of leaflet media is easy and practical. In addition, students also said that leaflet media helped learning to be more interesting and less boring. According to Afridah, et al. (2018), learning using leaflets can motivate students to learn independently because it can increase curiosity in exploring knowledge and information. In line with research conducted by Wati, et al. (2020) that the use of visual media is very influential on learning so that students can learn well and attract learning interest.

Students also stated that the material was presented in a simple, clear, easy to understand manner; and according to need. Students easily understand the material with the help of the pictures listed, the leaflet stimulates students to be more active in learning and better understand global warming material. Rahmatina, et al. (2020) in their research revealed that teaching materials based on STEM can support student knowledge and are designed so that students can think at a higher order in solving authentic problems in everyday life. This is also supported by the results of research by Wahono, et al. (2018) which shows that the teaching materials developed based on the STEM approach are significantly valid, practical, and effectively used as learning media. Based on the description, the developed leaflet using the STEM approach can be used in the learning process because the material is adjusted to core competence, basic competence, and science indicators for Junior High School. Overall, the validator's assessment of the learning tools developed were obtained with very feasible criteria categories, and showed that this learning tool could be used to support learning activities on global warming material.

Conclusion

Based on the results of the research that has been done, it can be concluded that the learning tools that have been developed have several characteristics, namely learning tools with the STEM approach, using leaflet media as a learning medium that is used to convey information, taking the theme of global warming as the main subject, and there are indicators of problem solving abilities in the learning tools developed; and there are indicators of activity in the learning tools developed; and science learning tools using the STEM approach to train problem solving ability and students' activeness on global warming material that has been developed are declared very suitable to be used to support learning.

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